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TREATMENT OF ANGINA PECTORIS OF ATHEROMATOUS ORIGIN BY LIGATION OF THE GREAT CARDIAC VEIN*

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IN 1935 certain experimental studies on dogs were undertaken by one of us (M.F.) on the assumption that ischæmia of the myocardium resulting from arteriosclerosis (atheroma) of the coronary arteries was not essentially different from that caused in the extremities by the same disease. This being so, it was hoped that surgical procedures which had been shown to be of value in treating diseases of the limbs[1, 2] might also be used for coronary sclerosis. These investigations have already been reported.[3]

One of the results was to show that after the great coronary vein had been ligated circulatory re-adjustments occurred in the coronary system which allowed the animals to survive subsequent ligation of the descending branch of the left coronary artery. The nature of these compensatory mechanisms is not thoroughly clear, but an important feature seems to be a rise in arterial pressure in the vascular field drained by the occluded vein. This field is the whole apical region, where is found most of the arteriosclerotic disease which can give rise to cardiac pain.

The experimental findings were such as to suggest that venous ligation would be of considerable value in the treatment of advanced coronary disease in the human. Consequently, on April 19, 1939, the first case, one of severe angina of effort, was operated upon at the Royal Victoria Hospital. More than two years have thus elapsed before the present publication of this case report.† During that period the patient has been entirely free from pain.

CASE REPORT

D.L., a French-Canadian male, aged 54, was admitted to hospital on March 22, 1939. He had for five years experienced pain in the midsternal region, radiating to the back, both shoulders, both sides of the mandible, and both arms as far as the wrists. Pain occurred only during exertion or excitement, forcing him to halt, and was never of more than five minutes' duration, except on the one occasion noted below. At first the attacks of pain appeared about once a fortnight, but their frequency and the ease with which they were induced increased each year; at the time of admission he was unable to walk slowly for more than a hundred yards on the level. An interesting point is that the pain could be induced by swallowing cold water.

Long periods of rest in bed, often of several weeks' duration, at different times during four years failed to influence appreciably the frequency of the attacks. In February, 1937, an unsuccessful attempt was made in another hospital to relieve his pain by paravertebral injections of alcohol.

On March 17, 1939, he had an attack of pain of the usual distribution which lasted for about three hours. He did not stay in bed, and afterwards noticed no difference in the character or frequency of his attacks.

He was a well-developed, thickset man of good colour and nutrition. Examination, apart from the cardiovascular system, was essentially negative. His pulse rate and temperature were normal, the blood pressure was 130/80. X-ray showed no cardiac enlargement; the heart sounds were distant, and a soft systolic murmur was heard at the pulmonic area. The blood Wassermann, hæmogram, and urine examinations were normal.

Electrocardiograms taken in May, 1936, and December, 1937 (see Fig. 1) were available for comparison. These demonstrate fairly conclusively that at some time between those dates an anterior coronary occlusion had occurred, although no satisfactory clinical history of such an event could be obtained. The tracing on admission showed a slight prolongation of auriculoventricular conduction (0.22 to 0.24 sec.), a diphasic T1, isoelectric T2, and negative T4, with widening of the QRS complexes, and is characteristic of an old myocardial infarction.

In hospital he was kept strictly in bed for four weeks, and during this time suffered only one attack of anginal pain, precipitated by anger.

Operation.—Quinidine was administered as a preventive measure against the development of ventricular fibrillation during the operation. Three grains were given on the afternoon before as a test dose, 6 grains in the evening, and 6 grains in the morning, two hours before operation.

A transverse incision was made from the mid-sternal line along the second left intercostal space, the fibres of the pectoralis major being separated by blunt dissection.

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† This case was demonstrated at Clinical Meetings of the Montreal Medico-Chirurgical Society on March 1, 1940, and March 7, 1941.

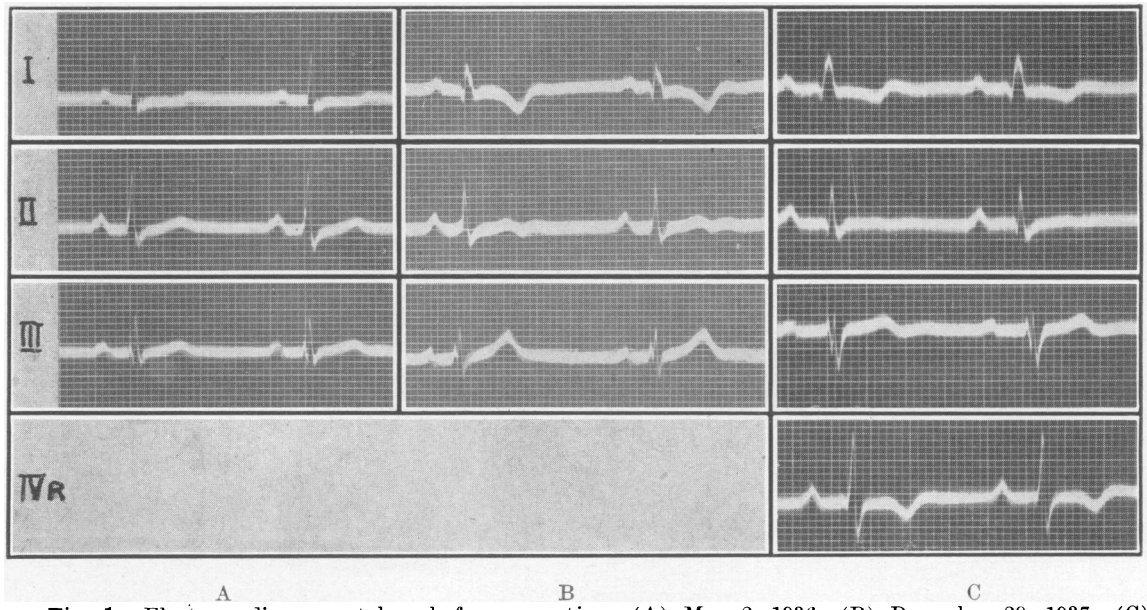

Fig. 1.—Electrocardiograms taken before operation: (A) May 2, 1936; (B) December 28, 1937; (C) March 30, 1939. Note evidence of coronary occlusion having occurred between the first two dates; this was confirmed by the finding of an old infarct at operation.

Through this incision portions of the second and third ribs, including their cartilages, 9.5 and 8 cm. respectively, were excised. The normal left lung and pleura were exposed with the tissues of the anterior mediastinum immediately under the edge of the sternum. With blunt gauze dissection the pleura and left lung were gradually pushed laterally so as to give access to the heart. A small tear in the pleura was immediately seen and caught with forceps and ligated. The pericardium was incised vertically, and about one ounce or two of clear pericardial fluid aspirated from the sac. After exposure of the heart, a small healed infarct was seen on the anterior surface. Branches of the left coronary artery were palpated and the anterior descending branch found to be rigid and sclerotic. The epicardium was caught by special long forceps near the origin of the great cardiac vein and the heart lifted forward slightly. A flat rubber balloon cushion was then introduced behind the heart with the object of pushing it forward and rotating it to the right by slow and gentle inflation. As this manœuvre induced extrasystoles—the only disturbance of rhythm noted during the operation—and caused a pronounced drop in blood pressure and inability to feel the radial pulse, it was abandoned, with immediate restoration of the pulse and blood pressure. A long gauze pack was then introduced gently behind the heart to support it. Dissection of the epicardium to expose the great cardiac vein just below the origin of the coronary sinus was a little troublesome on account of fat and capillary oozing, but this offered no serious difficulty and the vein when exposed was tied with a single ligature of No. 2 white pleated silk. The pericardium was left open, to prevent any possible pressure from reactionary pericardial fluid. The pectoral muscle was sutured with interrupted catgut and the skin closed without drainage.

Electrocardiograms were made at frequent intervals during the course of the operation (see Fig. 2), and these showed remarkably little variation. Under anæsthesia the P-R interval became normal, and slight changes in shape in the Q.R.S. complex were apparent before the vein was tied. The occurrence of ventricular extrasystoles when the balloon cushion was inflated behind the heart has already been mentioned. No change in the T-wave could be detected as an immediate effect of the ligation.

Subsequent course.—Immediately after the operation the patient was placed in an oxygen tent where he remained for several days. During the first two postoperative days his course was uneventful; there was no evidence of shock, and the blood pressure remained

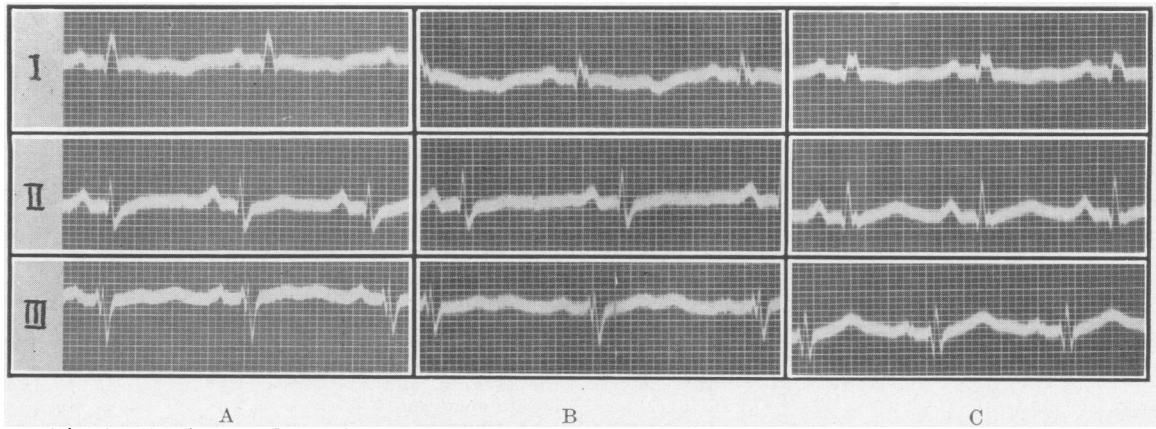

Fig. 2.—Tracings made at time of operation: (A) after anæsthetization but before incision; (B) five minutes after ligation of great cardiac vein; (C) two hours after completion of operation. The notching of QRS in Lead I was present before the actual ligation of the vein.

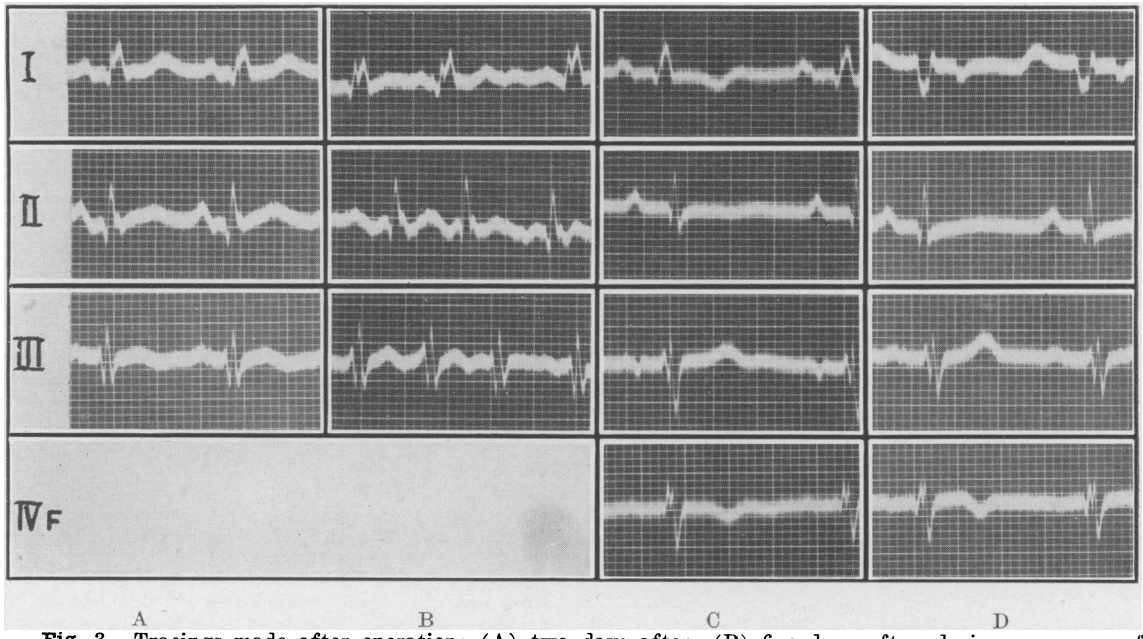

Fig. 3.—Tracings made after operation: (A) two days after; (B) five days after, during paroxysm of auricular fibrillation; (C) sixteen days after; (D) six months after. Note similarity of (C) and (D) and lack of any essential difference between them and pre-operative tracing [Fig. 1(C)].

around 100/70. On the third day a rise in temperature, pulse, and respiratory rate was noted, and pneumonia (type XVIII) of both lower lobes was found. A bout of cardiac arrhythmia suggestive of auricular fibrillation appeared at this stage, but the pulse was again regular when an electrocardiogram was taken (see Fig. 3A). The positive T-waves found in tracings 2(C), 3(A), and 3(B) should not be ascribed entirely, perhaps not even in part, to the operation; during this period the patient was in an oxygen tent, and this probably affected the electrocardiogram considerably. Sulfapyridine quickly brought the pneumonia under control. Paroxysms of auricular fibrillation, the longest one lasting for several hours (see Fig. 3(B)), continued to appear during the next week and then ceased. On May 11th the patient was allowed up in a wheel chair, and a week later was walking. His further stay in hospital was uneventful and he was discharged on June 6th.

Since then he has been seen at frequent intervals. He has been entirely free from pain and considers himself a well man. He has resumed his former occupation as janitor of a church: although it does not entail any heavy work, it is what he was not able to do before his operation. As early as February, 1940, he walked a distance of five miles without resting. The electrocardiograms at present show no essential difference from those made on May 5th, less than three weeks after his operation (see Fig. 3).

COMMENT

Indications for operation.—The best available yardstick wherewith to measure the effectiveness of the operation is, despite its admitted subjectiveness, the elimination of pain. That any relief from pain in the case here reported is brought about through an improvement in the coronary circulation rather than through any interruption of the nervous pathways seems fairly well assured. The argument cannot then be brought forward that the operation has only succeeded in removing a necessary danger signal. It is our opinion that for the present at least only patients with severe angina pectoris which has failed to respond adequately to medical treatment should be operated upon. In other words, until further experience with venous ligation is gained it should be regarded as a treatment for *angina pectoris* of atheromatous origin rather than for coronary disease as such.

Later, the advisability of operating on those who have recovered from one or more attacks of coronary thrombosis, *but are free from angina pectoris,* will have to be considered. The criterion of success would then presumably be the extent to which further attacks could be prevented, and the prolongation of life. To determine these would require observation of a fairly large series over many years and adequate control. The problem would be simplified if it were possible to foretell in which individual cases further attacks might with some degree of certainty be expected, but in the present state of our knowledge this is impossible. As regards duration of life after recovery from a first attack of coronary thrombosis, Palmer[4] has shown that 73 per cent may expect to be still alive at the end of five years and as many as 38 per cent at the end of ten years. It is necessary to take note of these observations and weigh them with the operative risk.

There is of course no indication that ligation of the vein is likely to prevent thrombosis from occurring in an atheromatous but still patent

coronary artery: here the logical method of attack would appear to be an alteration of the blood coagulability. There is, however, experimental evidence[3] that previous ligation will, by bringing about changes in the vascular bed, prevent the formation, or at least limit the size, of an infarct when the coronary artery is later tied off, and will under these circumstances prevent sudden death. This strongly suggests that the operation may yet find a place as a useful procedure in compensating beforehand for a future coronary occlusion.

Addendum. The result in this case was so encouraging that since then five more patients with severe angina pectoris have been operated upon. As in some cases the post-operative period is still short, it is proposed to describe them in detail in a later communication.

We wish to acknowledge with thanks the interest and co-operation shown by Professors J. C. Meakins and E. W. Archibald, and Dr. F. E. McKenty, Surgeon-in-Chief of the Royal Victoria Hospital.

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RÉSUMÉ

Expérimentalement, la ligature de la grande veine coronaire réalise de tels changements dans la circulation cardiaque que la ligature subséquente de la branche descendante de l'artère coronaire gauche peut s'effectuer sans effets désastreux pour l'animal en expérimentation. Ces travaux ont conduit à l'opération chez l'homme et le premier cas fut opéré en avril 1939. Le protocole du cas est décrit en détail; le malade n'a plus de signes angineux et il a repris ses occupations. Le meilleur critère de l'efficacité de l'opération est la cessation de la douleur. Jusqu'à présent l'opération devra se limiter aux cas qui n'ont pas répondu au traitement médical. Plus tard on pourra envisager l'opportunité d'opérer les malades qui ont eu quelques accès de thrombose coronarienne sans angine proprement dite; le critère de succès dans ces cas sera, évidemment, l'amélioration des malades. On espère déjà opérer les malades préventivement en vue d'obtenir la compensation circulatoire qui retardera ou empêchera l'occlusion coronarienne éventuelle.

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SURGICAL MANAGEMENT OF GASTRIC AND DUODENAL ULCERS

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GASTRIC and duodenal ulcer resulting in chronic and recurring periods of disability, especially in highly strung nervous types, or even in fairly stable persons exposed to excessive nervous strain, is a problem of increasing national importance. Hitherto this problem has been of interest mainly to sufferers from the disease and to the medical profession; more recently it has been forced on the attention of the civil and military authorities as well. In a group of soldiers recently repatriated to Canada approximately 25 per cent were suffering from duodenal ulcer. We have been told that over 1,000 cases have been sent back from England. These are probably not all new cases, but such a high incidence of ulcer in any group has never been previously reported.

Never in the history of the world has the entire military and civil population been in active front line warfare as it is today. The aeroplane has carried the battle to the individual's doorstep, and the radio brings it to his drawing room. This is having its influence on our civilian population. The effect is suggested by a recent review made by Dr. J. C. McMillan, radiologist of the Winnipeg General Hospital. He has observed a longer "ulcer season" than has obtained in previous autumns. In a three-month period the X-ray Department of the General Hospital has made radiographic studies on 25 cases of gastric ulcer and 35 cases of duodenal ulcer. These figures represent a very marked increase in the proportion of gastric ulcer, the usual ratio being gastric 1, duodenal 6. In the same series there has been an increase of over 200 per cent in the incidence of severe hæmorrhage from ulcer, as compared with previous series studied. Figures such as these have also been evident in our own private practice. These startling facts shown by the above figures, indicating an increase in the incidence and severity of ulcer, prompted a review of the problem and a study of the records of 730 cases of gastric